Report

Mean Reversion Strategy on Indian Equity

1. Introduction

This report documents the development, implementation, and evaluation of a quantitative mean reversion trading strategy applied to Indian equities. The strategy aims to capitalize on price deviations from statistical means, hypothesizing that prices will revert to their mean over time. The entire workflow is automated in Python, utilizing open-source libraries and real historical data.

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2. Data Acquisition and Preparation

2.1 Data Source

- **Provider:** Yahoo Finance (via yfinance Python library)
- **Instrument:** Example used - Reliance Industries (RELIANCE.NS), but applicable to any NSE-listed stock.
- **Period:** January 1, 2018 to December 31, 2023
- **Frequency:** Daily OHLCV (Open, High, Low, Close, Volume)

2.2 Data Cleaning

- Ensured columns are named exactly as required: Open, High, Low, Close, Volume.
- Flattened MultiIndex columns (which occur when multiple tickers are downloaded).
- Ensured the DataFrame index is a DatetimeIndex.
- Retained only the necessary columns for backtesting.

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3. Strategy Logic

3.1 Core Indicators

- **Bollinger Bands:** 20-period Simple Moving Average (SMA) with ±2 standard deviations.
- **Relative Strength Index (RSI):** 14-period, to identify overbought/oversold conditions.

- **Trend Filter:** 200-period SMA to avoid trading in strong trending markets.

3.2 Entry & Exit Rules

- **Buy (Long):**
    - Price < Lower Bollinger Band
    - RSI < 30 (oversold)
    - Market is sideways (price within 2% of 200-SMA)
- **Sell (Short):**
    - Price > Upper Bollinger Band
    - RSI > 70 (overbought)
    - Market is sideways
- **Exit:**
    - Close long when price crosses above SMA
    - Close short when price crosses below SMA
- **Stop-Loss:** 3% from entry price for risk management

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4. Backtesting Framework

- **Library Used:** backtesting.py
- **Initial Capital:** ₹100,000
- **Commission:** 0.1% per trade
- **Order Exclusivity:** Only one open position at a time

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5. Performance Evaluation

5.1 Metrics Calculated

Metric	Description
Cumulative Return	Total return over the backtest period
Annualized Return	Return normalized to yearly basis
Sharpe Ratio	Risk-adjusted return (volatility-based)
Sortino Ratio	Risk-adjusted return (downside risk only)
Maximum Drawdown	Largest equity drop from peak
Win Rate	Percentage of profitable trades

5.2 Visualization

- **Equity Curve:** Portfolio value over time
- **Drawdown Curve:** Visualizes risk and loss periods
- **Histogram of Returns:** Distribution of daily returns
- **Scatter Plot:** Sequence of daily returns

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6. Results

(Insert actual results here after running the notebook; example below)

Metric	Value
Cumulative Return	78.5%
Annualized Return	14.2%
Sharpe Ratio	1.08

Metric	Value
Sortino Ratio	1.45
Maximum Drawdown	-22.3%
Win Rate	57.1%

- The **equity curve** demonstrates steady growth with periods of drawdown.
- The **drawdown chart** indicates the maximum risk exposure during the backtest.
- The **histogram** and **scatter plot** provide insight into the consistency and distribution of returns.

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7. Error Handling and Debugging

- Ensured all column names and index formats are compatible with the backtesting framework.
- Added data validation steps to prevent runtime errors.

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10. References

- Yahoo Finance
- yfinance Python Library
- backtesting.py Documentation
- Matplotlib Documentation
- https://www.perplexity.ai/
- https://www.investopedia.com/
- https://zerodha.com/varsity/modules/